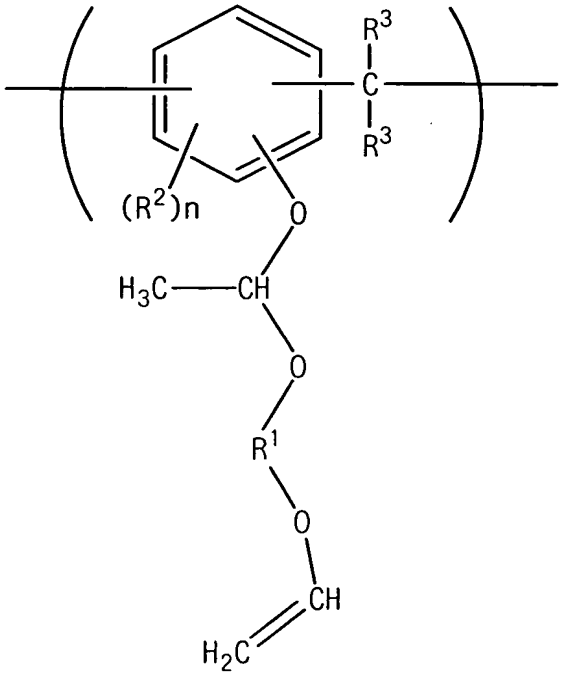
CLAIMS

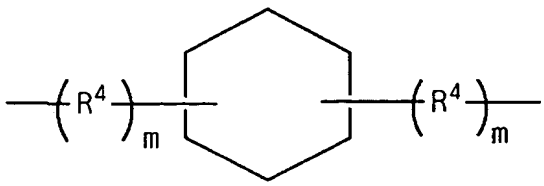
1. A chemical amplification type positive photoresist composition prepared by dissolving:

(A) a slightly alkali-soluble or alkali-insoluble novolak resin having a property that solubility in an aqueous alkali solution is enhanced in the presence of an acid, comprising either or both of a constituent unit (a1) represented by the following general formula (I):



···(I)

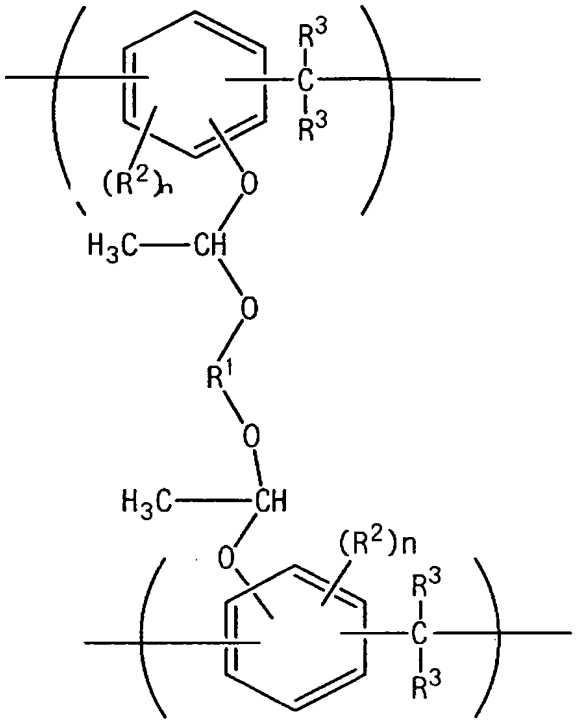
wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the following general formula (II):



···(II)

(wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a

substituent and m represents 0 or 1), the alkylene group may have an oxygen bond (ether bond) in the main chain, R^2 and R^3 each independently represents a hydrogen atom or an alkyl group having 1 to 3 carbon atoms, and n represents an integer of 1 to 3, and an intermolecular crosslinked moiety (a2) represented by the following general formula (III):



...(III)

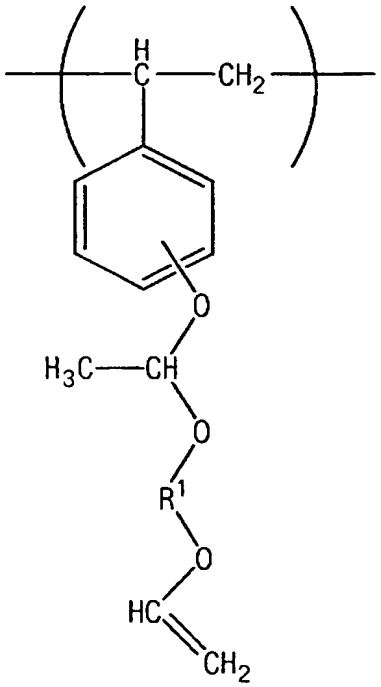
wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1), the alkylene group may have an oxygen bond (ether bond) in the main chain, R^2 and R^3 each independently represents hydrogen atom or alkyl group having 1 to 3 carbon atoms, and n represents an integer of 1 to 3; and

(B) a compound generating an acid under irradiation with radiation, in an organic solvent, wherein the content of an acid component is 10 ppm or less.

2. A chemical amplification type positive photoresist composition prepared by dissolving:

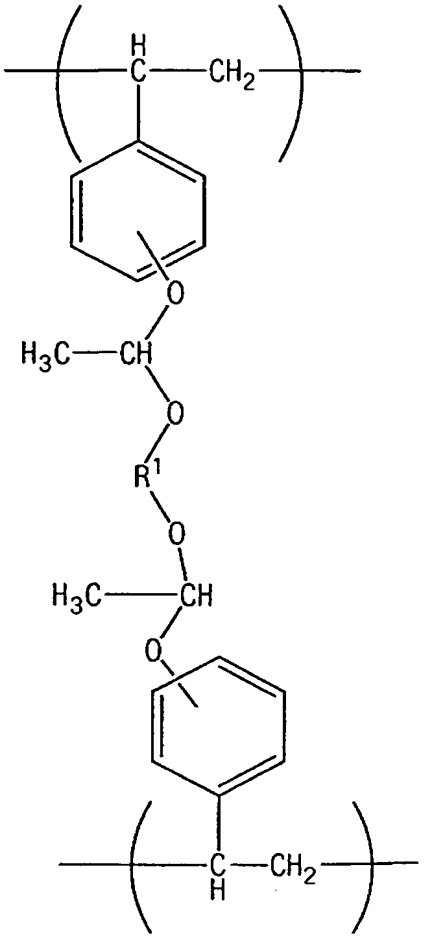
(A') an slightly alkali-soluble or alkali-insoluble polyhydroxystyrenic resin having a property that solubility in an aqueous alkali solution is enhanced in the presence of an acid, comprising either or both of a constituent unit (a'1) represented by the following general formula

(IV):



...(IV)

wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1), the alkylene group may have a oxygen bond (ether bond) in the main chain, and an intermolecular crosslinked moiety (a'2) represented by the following general formula (V):



...(V)

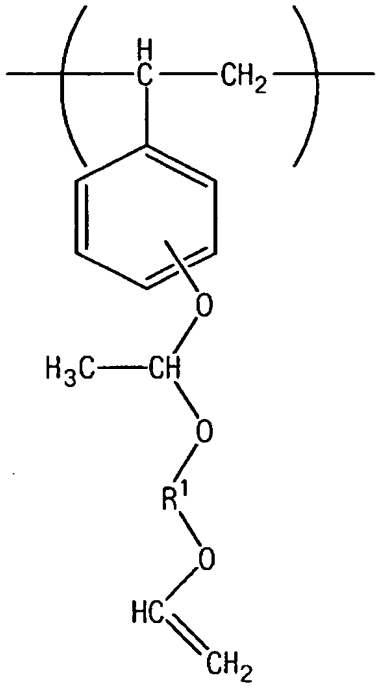
wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1), the alkylene group may have an oxygen bond (ether bond) in the main chain; and

(B) a compound generating an acid under irradiation with radiation, in an organic solvent, wherein the content of an acid component is 10 ppm or less.

3. A chemical amplification type positive photoresist composition prepared by dissolving:

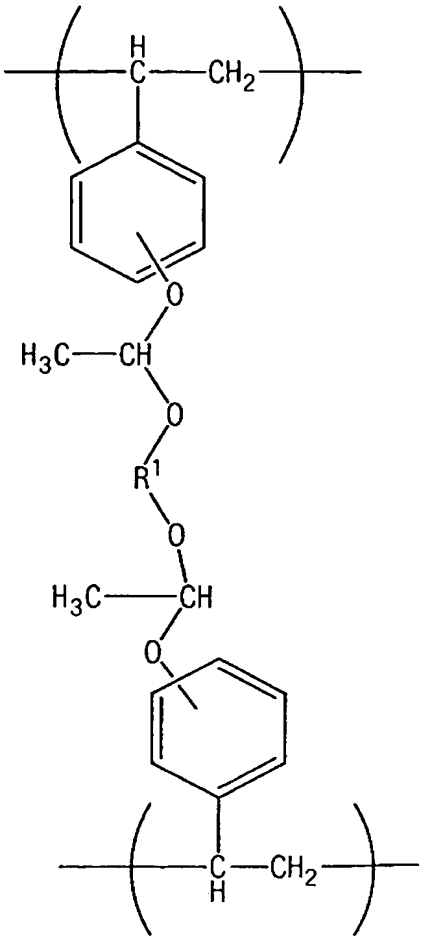
(A") a slightly alkali-soluble or alkali-insoluble polyhydroxystyrenic resin having such a property that solubility in an aqueous alkali solution is enhanced in the presence of an acid, comprising either or both of a constituent unit (a'1) represented by the following general formula

(IV):



...(IV)

wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1), the alkylene group may have an oxygen bond (ether bond) in the main chain, and an intermolecular crosslinked moiety (a'2) represented by the following general formula (V):



...(V)

wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1), the alkylene group may have an oxygen bond (ether bond) in the main chain, and a styrenic constituent unit; and

(B) a compound generating an acid under irradiation with radiation, in an organic solvent.

4. The chemical amplification type positive photoresist composition according to any one of claims 1 to 3, wherein the component (B) is a compound generating an acid under irradiation with i-rays (365 nm).

5. The chemical amplification type positive photoresist composition according to any one of claims 1 to 3, which further comprises a basic compound as the component (C).

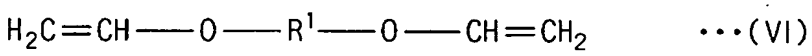
6. The chemical amplification type positive photoresist composition according to claim 5, which comprises the component (C) in the amount of 0.01 to 5 parts by weight based on 100 parts by weight of the resin component contained in the resist composition.

7. The chemical amplification type positive photoresist composition according to any one of claims 1 to 3, which comprises γ-butyrolactone.

8. The chemical amplification type positive photoresist composition according to any one of claims 1 to 3, which is used for a thick-film photolithography process used for forming a resist film having a thickness of about 2 to 7 μm.

9. The chemical amplification type positive photoresist composition according to claim 8, wherein the thick-film photolithography process is used for forming a resist pattern for implantation.

10. A method for synthesis of the component (A) of claim 1, which comprises reacting a novolak resin with a crosslinking agent represented by the following general formula (VI):

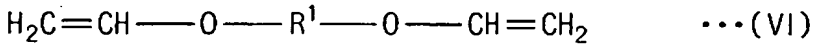


$$H_2C{=}CH{-}O{-}R^1{-}O{-}CH{=}CH_2 \qquad \cdots(VI)$$

wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4

represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1, and the alkylene group may have an oxygen bond (ether bond) in the main chain, in the substantial absence of an acid catalyst.

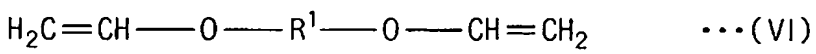
11. A method for synthesis of the component (A') of claim 2, which comprises reacting a hydroxystyrenic resin with a crosslinking agent represented by the following general formula (VI):



$$H_2C=CH-O-R^1-O-CH=CH_2 \qquad \cdots(VI)$$

wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1, and the alkylene group may have an oxygen bond (ether bond) in the main chain, in the presence of an acid catalyst.

12. A method for synthesis of the component (A") of claim 3, which comprises reacting a hydroxystyrenic resin with a crosslinking agent represented by the following general formula (VI):



$$H_2C=CH-O-R^1-O-CH=CH_2 \qquad \cdots(VI)$$

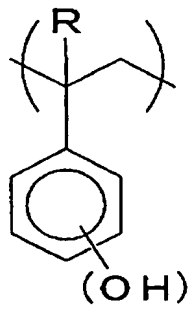
wherein R^1 represents either an alkylene group having 1 to 10 carbon atoms which may have a substituent or a group represented by the above general formula (II) (wherein R^4 represents an alkylene group having 1 to 10 carbon atoms which may have a substituent and m represents 0 or 1, and the alkylene group may have an oxygen bond (ether bond) in the main chain, in the presence of an acid catalyst.

13. A method for formation of a resist pattern of a thick-film photolithography process, which comprises forming a resist film having a thickness of 2 to 7 μm made of the chemical amplification type positive resist composition of any one of claims 1 to 3 on a substrate, and subjecting to selective exposure, post exposure bake (PEB) treatment, and development.

14. The method for formation of a resist pattern according to claim 13, wherein a resist pattern for implantation is formed in the thick-film photolithography process.

15. A chemical amplification type positive photoresist composition comprising (A2) a resin made of a reaction product of (A1) an alkali soluble resin and (C1) a crosslinking polyvinyl ether compound wherein alkali solubility enhances by an action of an acid, and (B1) a photo acid generator generating acid under irradiation with radiation, wherein

the component (A1) comprises a unit (a1') derived from (α-methyl)hydroxystyrene represented by the following general formula (I'):

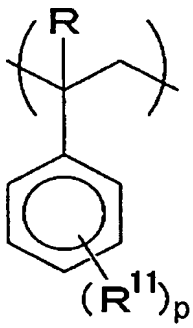


··· (I')

wherein R represents a hydrogen atom or a methyl group and l represents an integer of 1 to 3, and an alkali-insoluble unit (a2') having no acid dissociable dissolution inhibiting group, and wherein a dissolution rate of the component (A1) to an aqueous 2.38% by weight

solution of TMAH (tetramethylammonium hydroxide) is from 10 to 100 nm/second.

16. The chemical amplification type positive photoresist composition according to claim 15, wherein the constituent unit (a2') is a unit derived from (α-methyl)styrene represented by the following general formula (II'):



$(R^{11})_p$ ··· (II')

wherein R represents a hydrogen atom or a methyl group, R^{11} represents an alkyl group having 1 to 5 carbon atoms and p represents an integer of 0 or 1 to 3.

17. The chemical amplification type positive photoresist composition according to claim 16, wherein the content of constituent unit (a2') in the component (A1) is from 5 to 35 mol%.

18. The chemical amplification type positive photoresist composition according to claim 15, wherein the weight-average molecular weight of the component (A2) is from 20000 to 150000.

19. The chemical amplification type positive photoresist composition according to claim 15, wherein the component (B1) is a photo acid generator having a decomposition point of 120°C or higher.

20. The chemical amplification type positive photoresist composition according to claim 19, wherein the component (B1) is a poly(bissulfonyl)diazomethane photo acid generator.

21. The chemical amplification type positive photoresist composition according to claim 15, which further comprises a nitrogen-containing organic compound (D').

22. A resist pattern forming method, which comprises applying the chemical amplification type positive photoresist composition of claim 15 on a substrate, and subjecting to prebaking, selective exposure, PEB (post exposure bake) and alkali development to form a resist pattern.